

Growing Strawberries

IN THE HOME GARDEN

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**CALIFORNIA AGRICULTURAL EXTENSION
SERVICE • CIRCULAR 151 • MAY, 1949
THE COLLEGE OF AGRICULTURE
UNIVERSITY OF CALIFORNIA • BERKELEY**



The Delectable Strawberry

. . . is such a general favorite that countless home gardeners each year try to provide the family table with a generous supply of their own growing. Unfortunately, many home plantings are disappointing. They do not produce abundantly, or the berries are small, or the plants do not thrive and multiply properly.

This Circular will help the gardener have better success with strawberries. It will help him choose the right variety for his location. It describes the minimum conditions of soil, water, and sunlight which are necessary. And it gives step-by-step instructions for planting and maintaining the strawberry bed.

Strawberries are not easily grown. Time, careful planning, and tender care are necessary. But the results, in quantities of luscious fruit fresh from the vine—as many a gardener will agree—are worth it.

Growing Strawberries

IN THE HOME GARDEN

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THE POPULARITY of growing strawberries in the home garden depends upon the price of this fruit in the local market. At the present time there is much interest in this activity because many people feel that they cannot afford to pay the current retail prices. To establish and maintain a profitable strawberry planting, however, requires much more time and effort than most people realize. The home gardener should select the best facilities available and the simplest method of culture so that he will have a reasonably good chance of achieving success.

Choosing the Site

The homeowner must use the site he has for his strawberry bed, whether or not all conditions are the most favorable. There are certain minimum conditions, however, which are necessary for success in strawberry culture, and the gardener should appraise his property to see if these conditions are present. An adequate water supply is of prime importance. Soil conditions are important, but can be altered somewhat to make up for deficiencies. The site should not be shaded for many hours during the day, as strawberries require sunlight to attain best color, size, and flavor.

Water Supply

A strawberry planting must be irrigated frequently. In the interior valleys on very sandy soils, it may be necessary to irrigate every day or every other day

at the peak of the picking season during periods of very warm weather. On heavier soils one irrigation every third or fourth day may be sufficient. In the central and north coast areas, weekly irrigations during the summer months will usually supply an adequate amount of soil moisture. In coastal locations of southern California, moisture requirements are probably intermediate between those of the interior valleys and the central coast area. All urban locations are assumed to have an adequate water supply for the home garden. This may not always be the case in rural areas.

The quality of the water is as important as the quantity. The water must be free of sodium and chlorides in concentrations which would be injurious to plant growth. The concentration of these materials can be determined only by a chemical analysis. If the water supply is not satisfactory in regard to quantity and quality the strawberry planting will probably not live through the first year.

Soil Conditions

The ideal soil is one which is light in texture, at least 30 to 36 inches deep, well drained, and fertile. If the soil conditions are not ideal the home gardener may be justified in making certain adjustments which would not be practical on a commercial scale. Many acres of strawberries are grown in soils which do not have all of the ideal characteristics.

Texture: Although light soils are desirable, somewhat heavier soils may be used if they are well drained. The surface

SOME *Characteristics*

OF STRAWBERRY VARIETIES

VARIETY	SIZE	COLOR	FLAVOR	RESISTANCE TO DISEASES AND INSECTS	ADAPTATION
<i>Shasta</i>	Medium to large	Medium red	Fair	Moderately resistant to yellows	Central and north coast; southern San Joaquin Valley
<i>Sierra</i>	Medium to large	Lt. red, white tip	Fair	Resistant to yellows and verticillium	Central and north coast; Sierra foothills
<i>Lassen</i>	Medium to large	Lt. red	Fair to poor	Resistant to yellows and spider mites; moderately resistant to salinity	Central and north coast; Central Valley
<i>Tahoe</i>	Medium	Lt. red	Fair	Moderately resistant to yellows	Same as Lassen
<i>Donner</i>	Medium to large	Bright red	Good	Fair resistance to yellows and salinity	Same as Lassen
<i>Twentieth Century (Utah Everbearer)</i>	Medium to large	Medium red	Fair to poor	Fair resistance to yellows	Same as Lassen (Strawberry Barrel)
<i>Banner</i>	Medium to large	Medium to deep red	Very good	Resistant to verticillium; susceptible to yellows; (quickly infected with yellows in coastal areas)	Central Valley
<i>Rockhill</i>	Medium to large	Medium red	Good	Susceptible to yellows; resistant to verticillium	Throughout the State (Strawberry Barrel)
<i>Streamliner</i>	Small to medium	Light to medium red	Fair	Poor resistance to yellows	Poor performance in University test plots
<i>Klondike</i>	Medium	Light to medium red	Fair	Somewhat resistant to yellows; susceptible to salinity	Southern California
<i>Blakemore</i>	Medium	Lt. red	Fair	Moderate resistance to yellows and salinity	Southern California
<i>Missionary</i>	Medium	Light to medium red	Fair	Moderate resistance to yellows	Southern California

of heavy soils remains wet longer than the surface of light soils under similar environmental conditions. In many localities, where plantings are located in heavy soils, picking operations must be carried on while the soil is still wet at the surface. This difficulty can be overcome by proper handling of the irrigation water as discussed under "Preparation of Land," or by using boards to provide a dry walkway from which to pick the berries.

Depth: The soil may be somewhat shallower than 30 inches. Some strawberry plantings in the Sierra Nevada foothill area are located on sites where the soil is only a few inches deep. Applications of leaf mold, manure, and commercial fertilizers will help promote satisfactory growth in shallower soils.

Drainage: In all cases the soil must be well drained. This is one of the most im-

portant factors in strawberry culture. If natural drainage is not present it must be provided.

Fertility: Lack of native fertility in the soil can be made up for by good fertilization practices (page 10).

Salinity: Soils which are known to be highly saline should be avoided. None of the varieties grown in California at the present time is highly resistant to salinity. There are some differences in their resistance, however, as is brought out in the discussion of varieties.

Disease Infestation: If the site has been used for the production of tomatoes, potatoes, or cotton within the past 15 years the soil may be infected with verticillium wilt. Only the varieties Sierra and Banner are highly resistant to this soil-inhabiting disease, and are the varieties to plant in soil known to be infected.

Selecting Plants

The Varieties

Most home gardeners prefer a variety which rates high in flavor. There is not much pleasure in growing berries which have a poor flavor, even though they may be large and attractive. However, flavor is largely a matter of personal preference. Some home gardeners are thoroughly pleased with the flavor of varieties which are generally rated low by commercial standards.

In addition to flavor there are other factors which must be considered when deciding on the variety of plants to buy. Adaptation to growing areas and resistance to disease are two important considerations. These, as well as the commercial rating as to flavor, are given on page 4. There are no super varieties of strawberry—radio and other advertising notwithstanding. The public should not be misled into paying exorbitant prices for overrated plants. Relatively high prices for some varieties, however, may

be justified on the basis of high nursery costs. Under most California climatic conditions the plants of the Rockhill variety do not produce runners and must be propagated by division of the crown. This method of increase is slow and justifies a higher price than is paid for runner-producing plants. The Twentieth Century variety produces very few runner plants and the price may therefore be higher than that asked for varieties which produce many.

The following points may also affect one's choice of varieties:

Bearing Season: Shasta, Sierra, Lassen, Tahoe, Donner, and Banner varieties will produce from late April until fall in the central and north coast regions, but give only a spring crop in the hot interior valleys. The Twentieth Century, Rockhill, and Streamliner are everbearing types which yield fair crops from spring until fall wherever they are planted. Klondike, Blakemore, and Missionary varieties produce only a spring crop.

Frequency of Replanting: Most strawberry plantings in coastal locations will not produce satisfactorily for more than three years because of "strawberry yellows." In the interior of northern California many plantings produce good crops for 3 to 9 years. The Twentieth Century, Streamliner, and Rockhill varieties should be replanted at least every other year, and probably will give best results if replanted every year. In mild climates these varieties may produce better if they are chilled to break the rest period. The plants should be stored for 6 weeks at 32° to 34° F before planting each year. In southern California the Klondike, Blakemore, or Missionary will give acceptable yields for 3 or 4 years if the soil is not too saline. Many plantings are situated in highly saline soils and fail to produce even one satisfactory crop.

Buying Planting Stock

The success of the planting depends to a great extent upon the quality of the nursery stock. It is possible to obtain good plants of the Shasta, Sierra, Lassen, Tahoe, Donner, and Banner varieties from local nurserymen in California. Plants of these varieties which have been produced in coastal locations are more likely to be infected with virus diseases than those grown in the interior. The other varieties which are listed on page 4 are produced mostly out of state. The quality of the nursery stock of such varieties has varied considerably in the past. It is perhaps advisable to purchase through a local nurseryman.

The number of plants to order depends upon the amount of fruit which must be produced for the family, location of the planting, size of plot available, and the number of runners that one wishes to set from each mother plant.

In the central and north coast areas it is possible to obtain 2 pints of fruit per

plant per season. This is an excellent yield. One should probably not figure on more than an average of 1 pint per plant per season. In the interior and in southern California $\frac{1}{2}$ pint per plant per season is a fairly conservative estimate of yield.

Use of Runners: In calculating the number of nursery plants required, the home gardener may decide to buy enough to set a solid (complete) stand of nursery plants 8 to 10 inches apart in the row. This is the easiest method for establishing the planting. It does not require the use of runner plants, and results in a heavy yield the first season.

A more economical method consists of buying only one-fifth as many plants as are required for solid stands. They are planted far enough apart so that two runner plants can be set on each side of each nursery plant in the row. Each nursery plant purchased thus gives rise to four runner plants, two on each side, which are set 8 to 10 inches apart in the row. Each nursery plant is therefore called a mother plant.

Runner plants of only the Twentieth Century variety will form fruit during the season in which they are set. The amount of fruit per runner will be less than for the mother plant. The nursery plants of all varieties will produce some fruit the first picking season following planting. Thus, regardless of the variety used, if it is necessary to set runner plants in order to complete the stand, the yield during the first picking season will be less than for complete stands of nursery plants.

Nursery stock must be ordered several months in advance during seasons when extensive commercial acreages are being planted. Even during seasons when there may be an excess of some varieties, it is advisable to place the order early. This procedure will enable the local nurseryman to obtain for resale a sufficient number of plants of the desired varieties.

Planting

Time of Planting

The home gardener is usually anxious to obtain fruit as soon as possible. This can be done by planting all varieties except the Twentieth Century, Rockhill, and Streamliner in the fall (October, November). The plants become established during the fall, winter, and early spring. During the first producing season one should expect not more than half the normal production. A full crop will be obtained the second producing season. Fall, winter, and early spring plantings of the Twentieth Century, Rockhill, and Streamliner varieties will yield practically the same amount the first season. The other varieties will yield considerably less the first season if they are planted in the spring (March, April).

Late spring plantings in coastal areas usually result in less infection with yellows the first season. As a result the total production over a three- or four-year period may be greater than with fall planting. In the interior where strawberry yellows spreads more slowly, the time of planting does not affect the longevity as much as in coastal areas.

Care of Plants Before Setting

Upon receiving plants from the nurseryman, examine them carefully to determine their condition. The roots should be creamy-white in color throughout. If the plants were grown in red soil the roots may appear reddish in color. A few plants, selected at random, should be washed for careful examination. Numerous dark areas on the outside or inside portions of roots may indicate excessive drying at some stage of handling, or a diseased condition. The inner, young leaves should be bright green in color. A rotted condition of the leaves, crown, or roots would indicate that the plants may not survive in the field. If they appear to be dry or

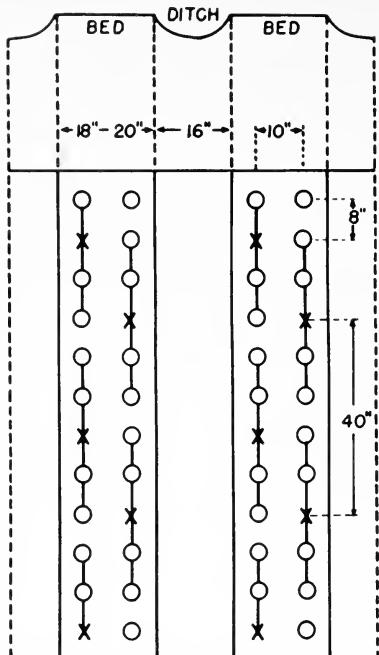
wilted, immerse them for a few minutes in water, drain, and then place in storage or plant immediately.

Preparation of Land

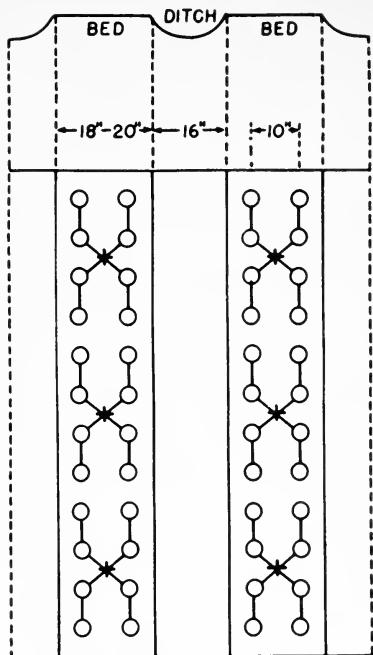
The area must be leveled very carefully. The soil should then be worked to a depth of approximately 8 inches as soon as possible after it has been moistened somewhat deeper than that by rain or pre-irrigation. It should be thoroughly pulverized so that it will pack easily around the roots of the strawberry plants. If necessary, a moderate application of well-rotted manure can be applied just before the soil is worked so that it will be incorporated into the surface soil; unrotted manure should be applied to the soil several months before planting.

Raised Bed: If the planting is located in a cool, coastal area, the irrigation water will be applied in furrows. In this case the plants must be set on raised beds. The planting arrangement which is the easiest to handle from the standpoint of weeding, setting runners, removing excess runners, and picking, is the single row, raised bed. This type of planting arrangement is illustrated on page 8. The plants are 8 to 10 inches apart in the row. The beds are 28 inches apart from center to center. They are approximately 5 to 6 inches high, 19 inches wide at the base, and taper to a ridge which is 11 inches wide. The furrows are 19 inches wide at the top and 11 inches wide at the bottom. If the soil is heavy, alternate furrows may be irrigated so that there will always be a dry furrow from which to pick the fruit. Double-row systems are shown on page 8. Other arrangements can be used but they are more difficult to maintain.

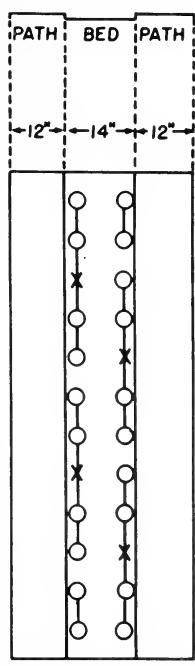
Flat Bed: In the interior where it is hot and dry during the picking season the plot may be flat-planted. In the flat bed the plants are set out in rows 18 inches apart on level, or flat ground. This system may be used on a slope without terraces if the rows are planted on the contour. This

A. RAISED-BED

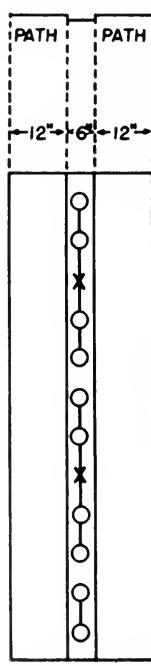
2 ROW SYSTEM N. CALIF.

B. RAISED-BED

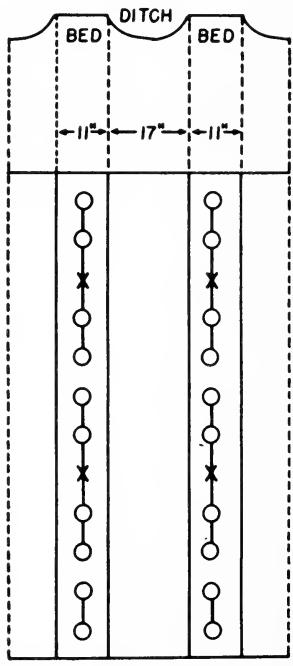
2 ROW SYSTEM S. CALIF.

C. FLAT-BED

DOUBLE ROW

D. FLAT-BED

SINGLE ROW

E. RAISED-BED

SINGLE ROW

+- MOTHER PLANT ○ - RUNNER OR DAUGHTER PLANT ○—○ - RUNNER CONNECTION

method must be irrigated by sprinkling because there are no furrows. It is adapted only to warm regions where the fruit will dry off rapidly after sprinkling. A mulch of straw or lawn clippings may be applied to the soil close to the plants so that the fruit will not become muddy. The mulch may also delay the development of fruit rot in the field. A mulch is not as necessary where raised beds are used, but it will offer, to some degree, the same advantages as it does for flat-planted areas.

Setting the Plants

Before planting, trim off all the leaves except the very youngest and cut the roots back to a length of about 4 inches. *Do not allow plants to dry out at any time.* If they are exposed to the sun or to drying conditions for more than a few minutes, the small, tender roots will become injured. The soil at the time of planting should not be so wet that it will cake or puddle. Allow soil to dry out just enough so that it will crumble when it is worked.

The actual planting operation is simple, but it must be followed carefully in order to insure a good stand. The most common method consists of opening a V-shaped hole by inserting a spade or trowel into the soil at the desired location and pushing it forward away from the operator. The spade is held in position in the soil while a plant is inserted into the hole to the proper depth with the roots spread out fan-shaped, and the spade is removed. The soil which was pulled away by the spade is then pushed into the hole against the roots by pressing with one hand or by stepping on it. One must place all of his weight on the one foot in order to pack the soil firmly all the way down to the bottom of the hole. Complete the operation by leveling the soil around the plants by hand and pressing it firmly around the crown with the fingers. If many plants must be set, one eventually becomes rather expert and it is not necessary to level off or pack the soil with the hands.

Depth of planting is very important. All of the roots at the point of origin from the crown should be covered, but the depth of covering should not be more than $\frac{1}{4}$ inch for the very uppermost root. Shallower planting exposes and dries out the roots; deeper planting may cause the crown to rot.

Even though the plants have been set in moist soil, the planting should be irrigated within a few hours after it has been completed. The irrigation water will complete the job of settling the soil firmly about all roots of each plant, in addition to replacing soil moisture which has been lost by evaporation during planting operations.

Maintenance

Irrigation

This subject has been discussed under "Water Supply" (page 3). It is mentioned here again to emphasize the importance of frequent irrigations. Strawberry plants must not suffer from lack of sufficient soil moisture at any time of the year. The major portion of the roots is located in the first foot of soil. It is extremely important to maintain adequate soil moisture to this depth.

The irrigation of a raised-bed type of planting requires only that the furrows must be filled with water. Since all furrows are supposed to be level it is merely necessary to fill each furrow with water from a garden hose. A sprinkler must be used for the irrigation of a flat-bed type of planting. The area should be sprinkled sufficiently so that the soil will be wet to a depth of 12 inches within 24 hours after the irrigation has been completed.

Cultivation

The primary purpose of cultivation is the removal of weeds. The most pro-

ductive strawberry plantings are those which are maintained free of weeds. The best time to remove weeds from the planting is when they are small. This can be done only by constantly working on the planting.

Occasionally cultivation may be necessary in order to create a mulch for reforming the furrows, or to fill the cracks in the soil so that the water will not run through them from one furrow to another. Cultivating will be done also when making a mulch on the top of the bed to set runner plants.

Fertilization

Nitrogen is the only element to which strawberries have definitely shown response in California. It is possible that future tests may prove that other elements should be applied in specific locations. However, until such proof is forthcoming the home gardener should apply nitrogen only.

In determining when to fertilize, the home gardener will probably take the appearance of the plants as the best indication. If the foliage is dark green, and the growth is vigorous, the plants probably do not require fertilizer. Pale green foliage indicates a need for nitrogen. Fertilizer for the spring crop should be applied about the time plants begin growth in the spring, which is usually during February in central California. If the planting indicates a need for nitrogen early in June a second application should be applied. This application may be beneficial to the blossoms which are formed during August, for the next spring crop of varieties which produce only a spring crop. It will benefit the fall crop of the varieties which produce a crop at that time of the year. A third application can be made in August. This may benefit the blossoms which are formed during the late fall for the spring crop in the Twentieth Century, Rockhill, and Streamliner, and in those varieties which are adapted to the central and north coast areas.

Commercial Fertilizer: Ammonium sulfate is the type of fertilizer which is generally used. It contains approximately 20.6 per cent nitrogen. Materials which are higher in nitrogen must be reduced in rate of application, and conversely those which are lower in nitrogen must be applied at a higher rate. The actual rate of application can be calculated on the basis of the per cent of nitrogen available in relation to 20.6 per cent for ammonium sulfate.

From 100 to 300 pounds ammonium sulfate per acre is the approximate range of rates which should be used for each application. One hundred pounds per acre, in terms of the home garden, is equivalent to approximately 1 pound for each 436 square feet of area. For 28-inch spacing between rows this would be equal to 1 pound in each 174 feet of furrow. Three hundred pounds per acre would be equal to 3 pounds in each 174 feet of furrow.

The fertilizer should be distributed as evenly as possible throughout the furrow, taking care to spread it fairly well up on the sides. It should then be worked into the surface soil with any suitable garden tool, preferably a rake. Finally, the entire area must be irrigated to dissolve the fertilizer and make the nitrogen available to the plants. For applications to smaller areas the proper calculations can be made from the figures given.

Manure: Strawberry plants can also be fertilized with well-rotted manure. This type of fertilizer is seldom used in home gardens, however, because it is difficult to handle. It must be applied in the furrows or area between the rows of plants and worked into the soil. The manure must be of small-particle size so that it can be readily incorporated with the surface soil. Poultry droppings and rabbit manure are used by some home gardeners.

The approximate amounts of the various manures to use on 174 feet of furrow or space between the rows of plants, 28 inches apart, are as follows: dry dairy

manure, 50 pounds; feed-lot steer manure, 23 pounds; poultry droppings, 12 pounds; rabbit manure, 25 pounds. These amounts represent the approximate quantities which are necessary to supply nitrogen at the rate of 50 pounds per acre. This would be equivalent to approximately 250 pounds of ammonium sulfate per acre, or 2.5 pounds per 174 feet of furrow or space between the rows of plants 28 inches apart.

Removal of Blossoms

Fall plantings should not be permitted to produce flowers and fruit. In order to obtain maximum yields the following season the plants must become well established during the fall, winter, and early spring. The development of flowers and fruit during the fall months will utilize food reserves which are needed for root and shoot growth. Early spring plantings and those which start growth rapidly will generally produce satisfactory vegetative growth even though they are permitted to form flowers and fruit. However, with late spring plantings and those which start growth slowly, blossoms should be removed as they appear, until vigor is assured.

Setting Runners

A few weeks after the total length of day (hours of sunshine per day) reaches a maximum for the year, each strawberry plant, except those of the Rockhill variety, forms runners, or stolons, from the crown. At alternate nodes (point of attachment of leaves) on each stolon, new plants are formed. The original stolons may branch several times throughout their length. Each branch continues to form plants at alternate nodes. Thus, a single mother plant of some varieties may form more than 100 runner plants. New runners will form until the total length of day is very short (October or November), and length growth will continue until the first severe frosts of fall. The use of runners to complete the stand of plants

has been illustrated on page 8 and discussed previously.

Cutting Runners: After the stand is completed all additional runners which are produced throughout the life of the planting must be cut off close to the point of origin at the crown of the mother plant. The runners which give rise to the new plants on each side of each mother are cut off just beyond the last runner plant which is desired. They must be left intact, however, from the mother to a few inches beyond the last runner plant. The runner plants must be nourished by the mother through the runners (stolons) until they become well established. If the runners are cut before this time the runner plant will wilt quickly and die. The portion of the runners between the plants will die during the late fall or early winter after the plants are set.

In order to bring about the proper soil moisture conditions for setting runners, the planting should be irrigated and then allowed to dry out just enough so that the soil can be worked readily. As mentioned previously, the runner plants form at alternate nodes on the stolon. They are easily identified because several leaves have already developed from the upper portion of the enlarged node and several roots may have started to push through the tissue on the lower side. If the lower part of the node has been lying on soft, moist soil some roots may have grown into the soil. In this case the roots must be pulled out of the soil in order to set the runner plant in the proper location.

One must be certain to select a runner having plants which can be set at the proper spacing. Even though the runner may have developed only one plant, this one may be set. If the runner is not injured it will produce additional terminal growth and eventually a second plant which can be set in the proper location. A trowel is used to loosen and turn up moist soil. The runner plant is pushed into this soil with the fingers, deep enough so that it will be held there securely. A

small clod can be placed on the runner near the plant to hold it in place.

Pruning

It is a common practice in the central coast region to cut the tops off the plants close to the crowns just as the new growth is beginning to push. This procedure may reduce fruit rot in the field. The removal of leaves may also be beneficial if they are harboring insect pests or diseases. In this case the leaves should be removed from the planting and burned immediately after they have been pruned off.

Control of Morning-glory

Morning-glory is a perennial weed which is often found in strawberry plantings. It can be controlled effectively, without injury to the strawberry plants of most varieties, by the use of 2,4-D. The directions on the container should be followed exactly, especially in regard to the rate of application. The first six varieties listed on page 4 are definitely known to be resistant to 2,4-D. Only a few plants of other varieties should be treated in an experimental way first, before spraying the entire planting to control morning-glory. The first noticeable effect of injury to morning-glory from this spray is in the leaves and runners, which twist and bend. If the test plants of a strawberry variety show twisting and bending of leaves and runners, the remainder of the planting should not be sprayed. Several weeks after treatment, the morning-glory plants which are seriously affected may show spongy, enlarged roots. It may require from four to eight weeks for the morning-glory to die down completely. More than one application of 2,4-D will be necessary.

Picking the Fruit

Strawberries must be picked as soon as they reach maturity, when they are completely colored or nearly so. If they are allowed to remain on the plant too long they will deteriorate in quality and

will eventually begin to decay and may cause adjacent fruits to rot. For this reason all decayed fruit should be removed from the plants at each picking. There may be many decayed fruits to remove after a prolonged rainy period.

The rate of maturity depends on the prevailing temperature. In the interior when the weather is relatively cool, it may be necessary to pick the entire planting only twice a week. During hot periods it may be necessary to pick every other day or even every day. In cool, coastal areas weekly pickings are usually sufficient.

If the fruit will be consumed quickly after picking it can be hulled in the field. In other words the stem and calyx (hull, cap) may be left on the plant. This method of picking saves work in the kitchen. If the berries must be held for several days they should be picked with the calyx attached. The picking is accomplished by grasping the berry between the thumb and first two fingers of either hand and breaking or pinching the stem off with pressure from the thumb or thumbnail.

Diseases and Insect Pests

Diseases

There are many diseases affecting the strawberry. Only those which are most important and of common occurrence are described here:

Strawberry Yellows is a virus disease which spreads most rapidly in coastal regions of the state. The severity and rate of spread in the interior is relatively less. However, diseased nursery plants will develop symptoms at some time during the year wherever they are planted in the state. Characteristic symptoms consist of a gradual decline and degeneration of the plant. The leaves are usually dwarfed, and yellowish on the margins. The leaves become cupped and distorted. In severe

cases there is a reduction in size, quality, and total quantity of fruit. There is no control for this disease after the plants become infected. One should buy nursery plants which are free of this disease. Such nursery stock is likely to degenerate more slowly than that which is already infected.

Verticillium Wilt is a disease often present in soils previously used for production of tomatoes, potatoes, or cotton. Strawberry plantings which follow these crops as much as 15 years later may become infected. If possible, one should select soil which has not been used for the production of tomatoes, potatoes, or cotton. If it is necessary to plant in soil which is known to be infested, resistant varieties should be used. The Sierra and Banner varieties listed on page 4 are resistant. All of the others have only fair to poor resistance. Characteristic symptoms consist of withering and browning of the outer leaves. Eventually most of the leaves may be affected and the plants may die. In severe cases the plants may wilt very suddenly and die.

Powdery Mildew occurs commonly in coastal regions. It may even occur in the interior during prolonged rainy periods in the spring. This disease will disappear during hot, dry weather. In areas where such dry weather conditions cannot be expected, it is necessary to use control measures. Dusting lightly with a very finely ground dusting sulfur is the most effective means of control. Plants which are affected by this disease show the following symptoms: leaves roll upward and inward, exposed portions become bronzed and dry, and powdery growth may develop on the succulent leaves and fruit.

Saline Injury

Soils or water which contain high concentrations of neutral salts are called saline. Strawberry plants which are planted in saline soils or irrigated with saline water may be injured. Strawberry plantings injured by salinity exhibit

symptoms which resemble those of verticillium wilt. Injury from moderate salinity is common in southern California. It also occurs in isolated areas in other parts of the state. In some instances it may be possible to correct the soil condition. The local Farm Advisor should be consulted in this regard. If the condition cannot be corrected it is usually not advisable to attempt to grow strawberries. The Lassen, Donner, and Blakemore varieties have fair resistance to salinity.

Insect Pests

Red-spider (spider mite) is the commonest pest of the strawberry. It may attack the plants at any time of the year. These mites are so small that they can be seen only with difficulty without the aid of a hand lens. They occur mostly on the undersides of the leaves, causing a graying of the foliage, a lack of vigorous growth, and may cause development of a web on the surface of the leaves. Mites can be controlled by spraying with hexaethyl tetraphosphate, which is sold under several different trade names. The rate of application of these materials will vary with the brand, and directions on the container should be followed carefully.

The **black root aphid** which normally occurs in the crown of the plant is sometimes a pest of strawberries. Ants tend the aphids, protect them by building mounds of soil in the crown. The aphids secrete quantities of honeydew which serves as food for the ants. Control of ants will serve as control for aphids. Chlordane is a material which is very effective in controlling ants. Dusts or emulsions can be applied directly to the plants. Manufacturer's directions should be followed regarding rate of application.

In coastal locations, and in some seasons in other areas of the state the light-colored leaf aphid appears in large numbers in early spring causing a "smutting" of the foliage. This insect can be controlled with dusts or sprays of nicotine sulfate or hexaethyl tetraphosphate ap-

plied according to directions on the container.

The leaf beetle, or strawberry root-worm, eats numerous small, elongated, irregular holes in the leaves. The adults are small, brown beetles with black markings. They are approximately $\frac{1}{8}$ inch

long. The larvae are small and white. They feed on the roots. A moderate dusting with a 5 per cent DDT dust when the adults are active in the spring will control this insect. The period of greatest activity usually occurs about the time the plants begin to bloom.

Planting a Strawberry Barrel

The strawberry barrel is an interesting novelty for the gardener. Use any iron-bound barrel which has been washed thoroughly to remove all materials which may be injurious to strawberry plants. Remove all hoops that are not properly located for the holes which must be provided as follows: Space five rows of holes, twelve to a row, around the barrel, placing the fifth row 5 inches from the top and the first row 8 inches from the bottom. The holes should be about $1\frac{1}{2}$ inches in diameter. Place two inches of fine gravel or coarse sand in the bottom of the barrel; then fill it with soil to the top of the first row of holes. Use good loam or sandy loam which is barely moist. Get into the barrel and tramp the soil until it is packed firmly and level with the top of the holes. It will be necessary to add a small quantity of soil during the packing process in order to attain the exact level required.

Loosen the soil around the holes just enough to allow insertion of the plants. The plants should be inserted into the first row of holes, roots first, far enough so that the crowns will be covered with soil to the proper depth as described for field planting. Only one plant should be inserted in each hole. Use only those varieties which are true everbearers, such as Twentieth Century or Rockhill. Spread the roots out well and cover with soil. Then continue to fill the barrel with soil half way up to the next row of holes.

Obtain a common drain tile about 12 inches long and 3 or 4 inches in diameter.

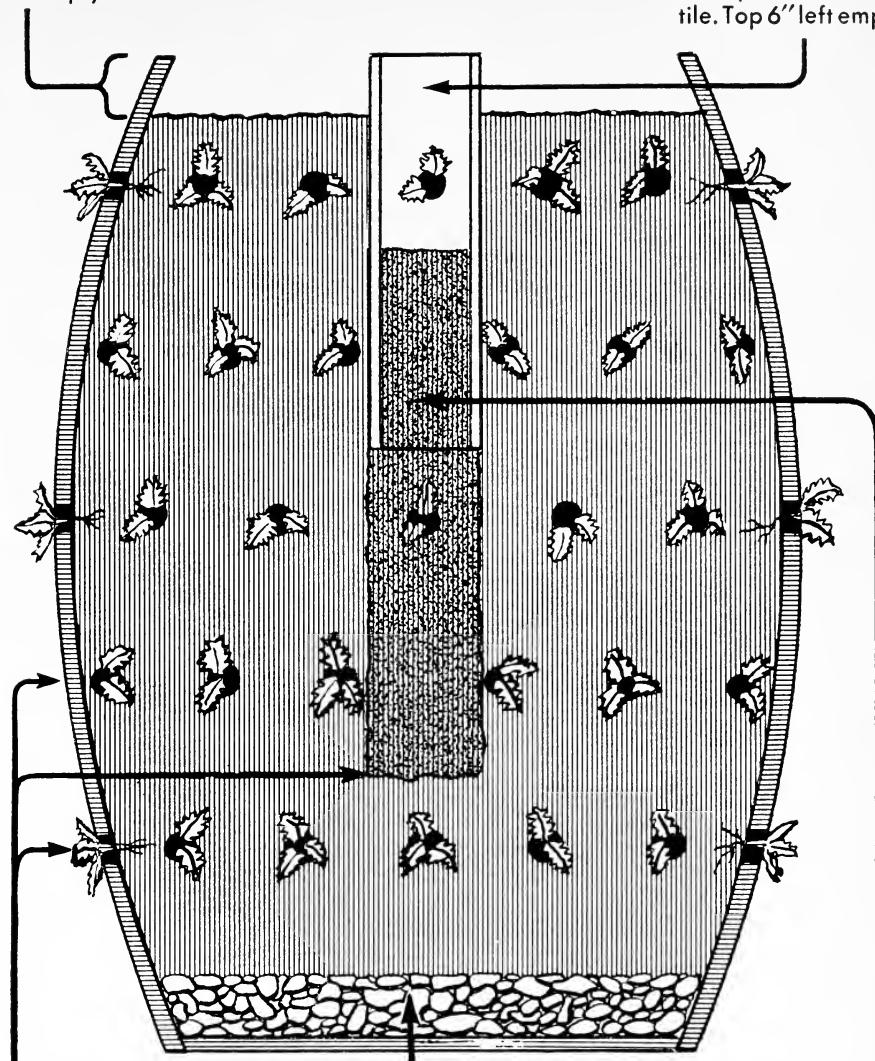
Stand it on end in the center of the barrel and fill it with coarse sand; then fill the barrel with soil to the top of the next row of holes. Tramp it firm and level as before, and plant the second row. After planting the second row, lift the tile several inches, allowing the sand to settle, and refill with sand. Fill the barrel with soil again to the top of the next row of holes, tramp and plant as before. Repeat until the five rows are planted.

The final position for the top of the tile should be flush with the top of the barrel, and the soil level should be two inches lower than this. The top 6 inches of the tile should be left empty. The lower rows should be irrigated through the tile and the two upper ones by applying water onto the surface of the soil in the barrel. All preceding discussions of operations for field plantings can be properly interpreted with respect to the production of strawberries in a barrel. The barrel should be placed in the sun to obtain satisfactory growth and production. It may be desirable to provide some means for rotating the barrel so that all plants will have uniform exposure to sunlight.

Chemical fertilizers should be dissolved in water before being applied. The strawberry barrel can be irrigated many times during the season with solutions of calcium nitrate, ammonium nitrate, or urammon. Use $\frac{1}{4}$ teaspoonful of calcium nitrate in 5 quarts of water, or $\frac{1}{4}$ teaspoonful of ammonium nitrate in 13 quarts of water, or $\frac{1}{4}$ teaspoonful of urammon in 20 quarts of water.

THE BARREL

Top 2" empty.



Barrel filled with sandy loam as planted. Planting done in 7 stages as indicated by rings, with soil packed firmly each time.

Bottom 2" coarse gravel:

Core of coarse sand inserted through tile. Tile moved up as barrel is filled.

Coöperative Extension work in Agriculture and Home Economics, College of Agriculture, University of California, and United States Department of Agriculture coöperating.

Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914.

C. W. Rubel, Acting Director, California Agricultural Extension Service.

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